SOLAR/1008-79/04

Monthly Performance Report

HOMES BY MARILYNN

APRIL 1979

U.S. Department of Energy

National Solar Heating and Cooling Demonstration Program

National Solar Data Program

4251

MONTHLY PERFORMANCE REPORT

HOMES BY MARILYNN

APRIL 1979

I. SYSTEM DESCRIPTION

The Homes by Marilynn site is a single-family residence in Albuquerque, New Mexico. Solar energy is used for space heating the home and preheating domestic hot water (DHW). The solar energy system has an array of flat-plate collectors with a gross area of 335 square feet. The array faces south at an angle of 55 degrees to the horizontal. A mixture of 35 percent ethylene glycol and 65 percent water is the transfer medium that delivers solar energy from the collector array to a liquid-to-liquid heat exchanger in the storage loop. It also delivers solar energy to a liquid-to-air heat exchanger in the space heating subsystem in order to preheat outside air for the heat pump. Solar energy is stored underground in a 1000-gallon water storage tank. The city supply water is preheated by continuously circulating water from a preheat tank through a heat exchanger in the storage tank. Preheated city water is stored in a 30-gallon preheat storage tank and supplied, on demand, to a conventional 40-gallon DHW tank. When solar energy is insufficient to satisfy the space heating load, a heat pump and an electrical heating element in the air-handling unit provide auxiliary energy for space heating. Similarly, an electrical heating element in the DHW tank provides auxiliary energy for water heating. The system, shown schematically in Figure 1, has five modes of solar operation.

Mode 1 - Collector-to-Storage: This mode activates when the temperature at the top of the collector is 10°F higher than the temperature in storage.

Mode 2 - Storage-to-Space Heating: This mode activates when there is a demand for space heating and the storage temperature is higher than 85°F.

Mode 3 - Storage-to-DHW Tank: This mode is active at all times with water continuously circulating between the DHW preheat tank and the storage tank.

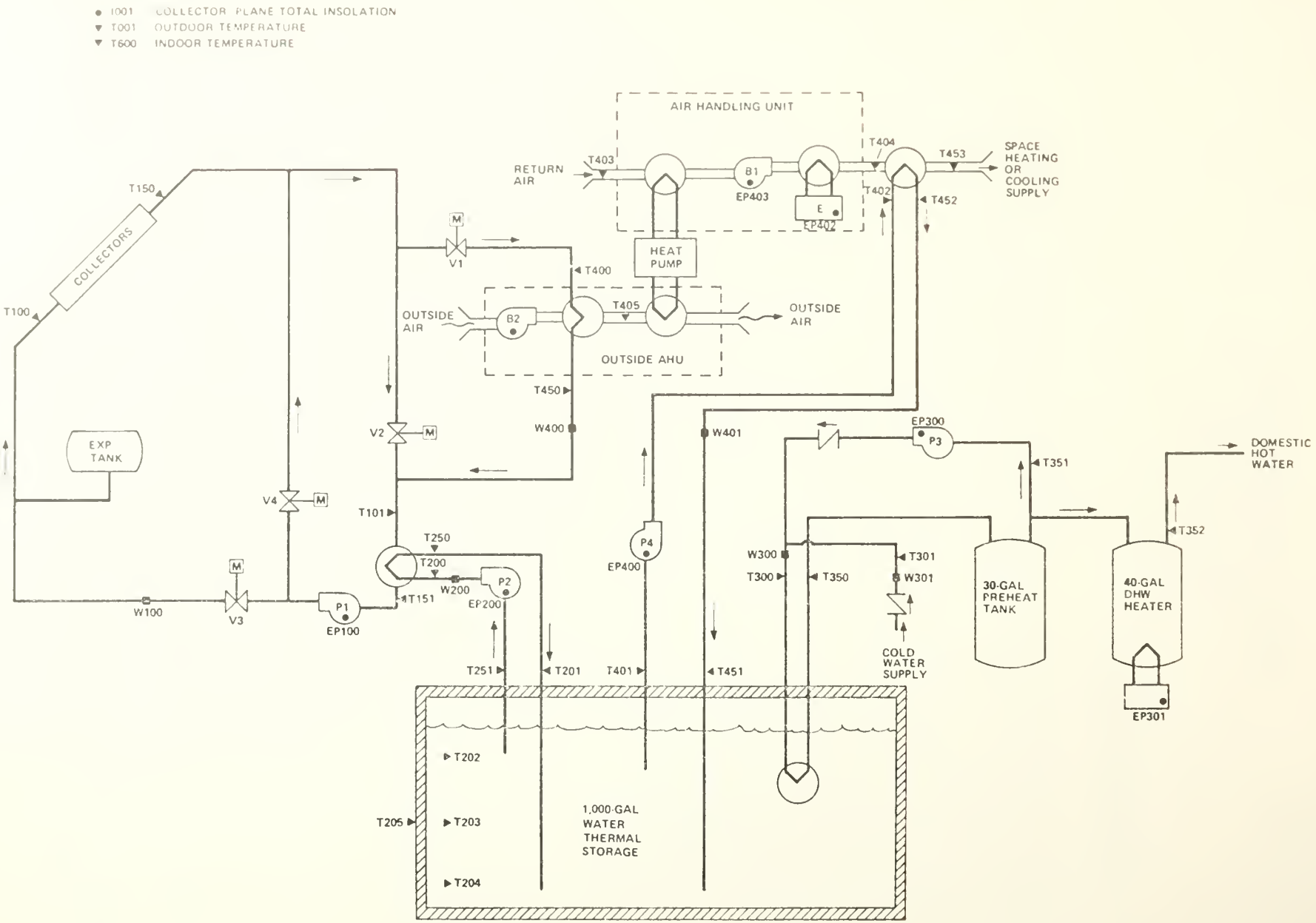

Figure 1. HOMES BY MARILYNN SOLAR ENERGY SYSTEM SCHEMATIC

Mode 4 - Collector-to-Storage and Heat Pump Assist: This mode activates when the conditions for mode 1 are satisfied, there is a demand for heat pump assistance for space heating, and the temperature of storage is higher than 135°F. During this mode, the outside air that is transferred across the heat pump coil is preheated.

Mode 5 - Storage-to-Preheat Assist: This mode activates when there is no flow through the collector, the temperature of storage is higher than 135°F, and a demand for heat pump assistance for space heating exists. The collector loop heat exchanger obtains energy from storage to preheat the outside air that is transferred across the heat pump coil.

II. PERFORMANCE EVALUATION

INTRODUCTION

The site was occupied in April, except for the period from April 14 to April 21. The solar energy system operated continuously during the month. Solar energy satisfied 70 percent of the DHW requirements and 53 percent of the space heating requirements. The solar energy system provided an electrical energy savings of 0.33 million Btu. Space heating was not required after April 16. The auxiliary heating element in the DHW loop burned out on April 20; therefore, the solar energy system provided DHW heating for the rest of the month.

WEATHER CONDITIONS

During the month, total incident solar energy on the collector array was 16.5 million Btu for a daily average of 1777 Btu per square foot. This was below the estimated average daily solar radiation for this geographical area during April of 2003 Btu per square foot for a south-facing plane with a tilt of 55 degrees to the horizontal. The average ambient temperature during April

was 53°F as compared with the long-term average for April of 56°F. The number of heating degree-days for the month (based on a 65°F reference) was 360, as compared with the long-term average of 282. The number of cooling degree-days was 9, as compared with the average of 6. The ambient temperature sensor (T001) provided erroneous readouts intermittently during the month. The affect on the average temperature reading above is not able to be determined; however, another solar installation in the Albuquerque area measured an average ambient temperature of 57°F.

THERMAL PERFORMANCE

Collector - The total incident solar radiation on the collector array for the month of April was 16.5 million Btu. During the period the collector loop was operating, the total insolation amounted to 11.4 million Btu. The total collected solar energy for the month of April was 3.7 million Btu, resulting in a collector array efficiency of 23 percent, based on total incident insolation. Solar energy delivered from the collector array to storage was 4.1 million Btu.

The apparent 0.4 million Btu gain in solar energy delivered to storage over the amount collected is an obvious impossibility. The flow rates measured by sensors W100 and W200 should remain constant throughout a period of continuous collection, but the rates varied by as much as 15 percent throughout the month. The source of this variation has not been determined. However, potential sources are: an erroneous measurement capability through the flow sensors, actual flow variance caused by the collector pump, and/or inconsistent operation of values V1 and V2. On April 20 a much higher rate variation began to occur through W100. As much as a 50 to 60 percent difference occurred by the end of the month. Whether the condition is the result of a new failure or degradation of the earlier problem has not been determined. An investigation is continuing in order to locate and correct the cause of the collector-to-storage imbalance.

There was 0.54 million Btu of operating energy required by the collector loop during April.

Storage - Solar energy delivered to storage was 4.1 million Btu. There were 1.7 million Btu delivered from storage to the DHW and space heating subsystems. Energy loss from storage was 2.2 million Btu. This loss represented 54 percent of the energy delivered to storage. The storage efficiency was 46 percent: This is calculated as the ratio of the sum of the energy removed from storage and the change in stored energy, to the energy delivered to storage. The average storage temperature for the month was 135°F.

DHW Load - The DHW subsystem consumed 0.80 million Btu of solar energy and 0.58 million Btu of auxiliary electrical energy to satisfy a hot water load of 0.99 million Btu. The solar fraction of this load was 70 percent. Losses from the DHW subsystem were 0.40 million Btu. The DHW subsystem consumed a total of 0.23 million Btu of operating energy, resulting in an electrical energy savings of 0.48 million Btu. A daily average of 63 gallons of DHW was consumed at an average temperature of 133°F delivered from the tank. There was no hot water required during the homeowners absence between April 14 and April 21. On April 20 the heating element in the hot water tank burned out. All hot water used for the rest of the month was heated by solar energy.

Space Heating Load - The space heating requirement for April was 1.6 million Btu, all of which occurred prior to April 16. The solar energy system provided 0.88 million Btu or 53 percent of this requirement. The remaining load of 0.77 million Btu was satisfied by an auxiliary electrical heat pump and an electrical heating element at an electrical consumption of 0.29 million Btu. The space heating subsystem consumed an additional 0.22 million Btu of operating energy. A net electrical energy savings of 0.40 million Btu was obtained by the solar portion of the space heating subsystem.

OBSERVATIONS

The space heating subsystem is designed to utilize solar energy as long as the storage temperature is higher than 85°F. Measurements of storage indicate that the use of solar energy for space heating terminates when the storage temperature decreases to 105°F. The continuous cycling DHW preheat loop continues to extract energy from storage as long as there is a demand in the DHW preheat tank. Storage must be reheated in order to replace the storage losses and the energy used by the DHW preheat before space heating by the solar energy system can be accomplished.

In order to heat the house, mode 4 and mode 5 require the use of the heat pump and a storage temperature of at least 135°F. The heat pump is only used to heat the house upon a second-stage thermostat heating requirement (house temperature is "n" degrees less than the thermostat setting). The only time that these criteria can be met is when mode 2 is not functioning. Since the valves and flow rate in the collector loop are potential sources of the imbalance in energy calculations, elimination of the heat pump assist functions may be worth considering.

ENERGY SAVINGS

The solar energy system provided a net electrical energy savings of 0.33 million Btu. The DHW subsystem provided an electrical energy savings of 0.48 million Btu and the space heating subsystem provided an electrical energy savings of 0.40 million Btu. The collection and storage subsystem incurred an electrical energy expense of 0.55 million Btu.

III. ACTION STATUS

Varying flow rates through the collector flow rate sensor (W100) are affecting the energy collection calculation. An investigation is continuing to determine whether the measurement sensor or an erratic flow is the cause.

The temperature sensor that measures the inside ambient temperature was insulated on April 7 by the grantee to eliminate the affect of heat from the solar energy equipment room.

Boeing is planning to replace the temperature sensor (T1001) that measures the outside ambient temperature.

The grantee is planning to replace the DHW heating element in May.

The grantee is evaluating whether the deactivation of the solar portion of the space heating subsystem is acceptable at a 105°F storage temperature or should it be corrected to operate in the 85°F design level.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SITE SUMMARY

SITE: HOMES BY MARILYN
REPORT PERIOD: APRIL,1979

SOLAR/1008-79/04

SITE/SYSTEM DESCRIPTION:
HOMES BY MARILYN IS A SINGLE FAMILY DWELLING. THE HEAT PUMP IS ASSISTED BY SOLAR ENERGY DURING THE HEATING CYCLE. NO SOLAR ENERGY IS USED IN ASSISTING THE COOLING CYCLE OF THE HEAT PUMP. HOWEVER, A DOMESTIC HOT WATER LOAD IS REQUIRED YEAR-ROUND.

GENERAL SITE DATA:

INCIDENT SOLAR ENERGY	16.525 MILLION BTU
	53307 BTU/SQ.FT.
COLLECTED SOLAR ENERGY	3.728 MILLION BTU
	12026 BTU/SQ.FT.
AVERAGE AMBIENT TEMPERATURE	53 DEGREES F
AVERAGE BUILDING TEMPERATURE	77 DEGREES F
ECSS SOLAR CONVERSION EFFICIENCY	0.10
ECSS OPERATING ENERGY	0.544 MILLION BTU
TOTAL SYSTEM OPERATING ENERGY	0.987 MILLION BTU
TOTAL ENERGY CONSUMED	5.589 MILLION BTU

SUBSYSTEM SUMMARY:

	HOT WATER	HEATING	COOLING	SYSTEM TOTAL
LOAD	0.989	1.649	N.A.	2.640 MILLION BTU
SOLAR FRACTION	70	53	N.A.	59 PERCENT
SOLAR ENERGY USED	0.804	0.875	N.A.	1.679 MILLION BTU
OPERATING ENERGY	0.228	0.215	N.A.	0.987 MILLION BTU
AUX. THERMAL ENERGY	0.583	0.204	N.A.	0.787 MILLION BTU
AUX. ELECTRIC FUEL	0.583	0.291	N.A.	0.874 MILLION BTU
AUX. FOSSIL FUEL	N.A.	N.A.	N.A.	N.A. MILLION BTU
ELECTRICAL SAVINGS	0.479	0.397	N.A.	0.333 MILLION BTU
FOSSIL SAVINGS	N.A.	N.A.	N.A.	N.A. MILLION BTU

SYSTEM PERFORMANCE FACTOR: 0.426

* DENOTES UNAVAILABLE DATA
@ DENOTES NULL DATA
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT OF THE NATIONAL SOLAR DATA PROGRAM,FEBRUARY 28,1978, SOLAR/0004-78/18

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SITE SUMMARY

SITE: HOMES BY MARILYN
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GENERAL SITE DATA:

INCIDENT SOLAR ENERGY	17.434 GIGA JOULES
	605356 KJ/SQ.M.
COLLECTED SOLAR ENERGY	3.933 GIGA JOULES
	136566 KJ/SQ.M.
AVERAGE AMBIENT TEMPERATURE	12 DEGREES C
AVERAGE BUILDING TEMPERATURE	25 DEGREES C
ECSS SOLAR CONVERSION EFFICIENCY	0.10
ECSS OPERATING ENERGY	0.574 GIGA JOULES
TOTAL SYSTEM OPERATING ENERGY	1.041 GIGA JOULES
TOTAL ENERGY CONSUMED	5.896 GIGA JOULES

SUBSYSTEM SUMMARY:

	HOT WATER	HEATING	COOLING	SYSTEM TOTAL
LOAD	1.044	1.740	N.A.	2.785 GIGA JOULES
SOLAR FRACTION	70	53	N.A.	59 PERCENT
SOLAR ENERGY USED	0.848	0.923	N.A.	1.771 GIGA JOULES
OPERATING ENERGY	0.240	0.227	N.A.	1.041 GIGA JOULES
AUX. THERMAL ENG	0.615	0.215	N.A.	0.830 GIGA JOULES
AUX. ELECTRIC FUEL	0.615	0.307	N.A.	0.922 GIGA JOULES
AUX. FOSSIL FUEL	N.A.	N.A.	N.A.	N.A. GIGA JOULES
ELECTRICAL SAVINGS	0.505	0.419	N.A.	0.351 GIGA JOULES
FOSSIL SAVINGS	N.A.	N.A.	N.A.	N.A. GIGA JOULES

SYSTEM PERFORMANCE FACTOR: 0.426

* DENOTES UNAVAILABLE DATA
@ DENOTES NULL DATA
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REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT OF THE NATIONAL SOLAR DATA PROGRAM,FEBRUARY 28,1978, SOLAR/0004-78/18

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
ENERGY COLLECTION AND STORAGE SUBSYSTEM (ECSS)

SITE: HOMES BY MARILYN
REPORT PERIOD: APRIL,1979

SOLAR/1008-79/04

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	AMBIENT TEMP DEG-F	ENERGY TO LOADS MILLION BTU	AUX THERMAL TO ECSS MILLION BTU	ECSS OPERATING ENERGY MILLION BTU	ECSS ENERGY REJECTED MILLION BTU	ECSS SOLAR CONVERSION EFFICIENCY
1	0.645	32	0.147	N	0.026	N	0.228
2	0.486	32	0.066	O	0.023	O	0.136
3	0.621	35	0.095	T	0.022	T	0.154
4	0.713	45	0.157		0.029		0.220
5	0.690	47	0.074	A	0.031	A	0.108
6	0.664	45	0.064	P	0.027	P	0.097
7	0.675	46	0.029	P	0.026	P	0.043
8	0.626	46	0.056	L	0.022	L	0.089
9	0.326	40	0.046	I	0.009	I	0.140
10	0.299	33	0.157	C	0.002	C	0.525
11	0.391	30	0.058	A	0.007	A	0.149
12	0.513	39	0.074	B	0.021	B	0.145
13	0.676	50	0.093	L	0.030	L	0.138
14	0.666	58	0.074	E	0.031	E	0.111
15	0.662	64	0.057		0.027		0.086
16	0.421	67	0.009		0.014		0.021
17	0.611	70	0.014		0.020		0.023
18	0.651	66	0.015		0.019		0.023
19	0.655	62	0.018		0.014		0.027
20	0.659	57	0.021		0.020		0.031
21	0.622	61	0.018		0.017		0.029
22	0.591	63	0.023		0.015		0.038
23	0.399	62	0.037		0.006		0.093
24	0.455	63	0.062		0.012		0.135
25	0.539	66	0.054		0.016		0.101
26	0.383	63	0.047		0.010		0.123
27	0.499	65	0.021		0.017		0.042
28	0.424	64	0.035		0.010		0.083
29	0.428	64	0.024		0.010		0.056
30	0.534	62	0.033		0.010		0.062
SUM	16.525	-	1.679	N.A.	0.544	N.A.	-
AVG	0.551	53	0.056	N.A.	0.018	N.A.	0.102
NBS ID	Q001	N113			Q102		N111

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

MONTHLY REPORT
COLLECTOR ARRAY PERFORMANCE

SITE: HOMES BY MARILYN
REPORT PERIOD: APRIL,1979

SOLAR/1008-79/04

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	OPERATIONAL INCIDENT ENERGY MILLION BTU	COLLECTED SOLAR ENERGY MILLION BTU	DAYTIME AMBIENT TEMP DEG F	COLLECTOR ARRAY EFFICIENCY
1	0.645	0.517	0.180	45	0.279
2	0.486	0.357	0.110	44	0.226
3	0.621	0.457	0.152	42	0.245
4	0.713	0.617	0.218	59	0.305
5	0.690	0.611	0.224	65	0.324
6	0.664	0.571	0.208	59	0.313
7	0.675	0.566	0.181	60	0.268
8	0.626	0.488	0.155	60	0.247
9	0.326	0.162	0.039	48	0.120
10	0.299	0.043	0.014	38	0.047
11	0.391	0.134	0.042	35	0.109
12	0.513	0.386	0.117	50	0.228
13	0.676	0.599	0.216	65	0.319
14	0.666	0.603	0.224	79	0.336
15	0.662	0.564	0.192	84	0.291
16	0.421	0.251	0.070	83	0.166
17	0.611	0.455	0.142	83	0.232
18	0.651	0.441	0.127	80	0.195
19	0.655	0.362	0.116	74	0.176
20	0.659	0.473	0.149	74	0.226
21	0.622	0.400	0.113	78	0.181
22	0.591	0.380	0.114	77	0.192
23	0.399	0.147	0.048	77	0.121
24	0.455	0.217	0.043	77	0.095
25	0.539	0.384	0.119	77	0.221
26	0.383	0.208	0.068	75	0.179
27	0.499	0.353	0.100	79	0.201
28	0.424	0.237	0.074	*	0.174
29	0.428	0.206	0.073	74	0.171
30	0.534	0.250	0.100	76	0.187
SUM	16.525	11.440	3.728	-	-
AVG	0.551	0.381	0.124	66	0.226
NBSID	Q001		Q100		N100

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL CATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
STORAGE PERFORMANCE

SITE: HOMES BY MARILYN
REPORT PERIOD: APRIL,1979

SOLAR/1008-79/04

DAY OF MONTH	ENERGY TO STORAGE MILLION BTU	ENERGY FROM STORAGE MILLION BTU	CHANGE IN STORED ENERGY MILLION BTU	STORAGE AVERAGE TEMP DEG F	STORAGE EFFICIENCY
1	0.208	0.147	-0.002	109	0.695
2	0.133	0.066	-0.008	107	0.440
3	0.176	0.095	0.008	107	0.590
4	0.251	0.157	0.026	111	0.729
5	0.258	0.074	0.096	117	0.661
6	0.236	0.064	0.088	128	0.646
7	0.202	0.029	0.087	140	0.576
8	0.175	0.056	0.014	147	0.397
9	0.045	0.046	-0.077	143	-0.690
10	0.014	0.157	-0.185	128	-1.989
11	0.032	0.058	-0.057	108	0.035
12	0.132	0.074	0.011	106	0.642
13	0.246	0.093	0.076	113	0.688
14	0.250	0.074	0.102	121	0.707
15	0.229	0.057	0.084	134	0.616
16	0.076	0.009	-0.004	142	0.067
17	0.171	0.014	0.070	146	0.489
18	0.143	0.015	0.032	153	0.330
19	0.120	0.018	0.016	155	0.282
20	0.142	0.021	0.031	159	0.364
21	0.122	0.018	0.020	162	0.307
22	0.111	0.023	-0.001	164	0.201
23	0.039	0.037	-0.081	159	-1.111
24	0.047	0.062	-0.080	148	-0.384
25	0.123	0.054	-0.009	142	0.369
26	0.066	0.047	-0.047	139	0.001
27	0.114	0.021	0.026	136	0.413
28	0.080	0.035	-0.008	138	0.338
29	0.075	0.024	-0.011	137	0.178
30	0.092	0.033	-0.008	136	0.273
SUM	4.109	1.679	0.211	-	-
AVG	0.137	0.056	0.007	135	0.460
NBS ID	Q200	Q201	Q202		N108

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
HOT WATER SUBSYSTEM

SITE: HOMES BY MARILYN
REPORT PERIOD: APRIL,1979

SOLAR/1008-79/04

DAY OF MON.	HOT WATER LOAD MILLION BTU	SOLAR FR.OF LOAD PER CENT	SOLAR ENERGY USED MILLION BTU	OPER ENERGY MILLION BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FOSSIL FUEL MILLION BTU	ELECT ENERGY SAVINGS MILLION BTU	FOSSIL ENERGY SAVINGS MILLION BTU	SUP. WAT. TEMP DEG F	HOT WAT. TEMP DEG F	HOT WATER USED GAL
1	0.099	55	0.034	0.008	0.061	0.061	N	0.038	N	61	133	182
2	0.079	41	0.028	0.008	0.058	0.058	O	0.027	O	61	136	132
3	0.048	51	0.016	0.008	0.033	0.033	T	0.017	T	61	130	87
4	0.059	56	0.032	0.008	0.050	0.050		0.022		62	130	107
5	0.032	46	0.018	0.008	0.036	0.036	A	0.010	A	62	130	52
6	0.049	58	0.033	0.008	0.029	0.029	P	0.025	P	63	137	83
7	0.028	61	0.029	0.008	0.025	0.025	P	0.013	P	63	137	42
8	0.060	78	0.053	0.008	0.023	0.023	L	0.043	L	64	139	99
9	0.065	78	0.046	0.008	0.029	0.029	I	0.043	I	65	137	113
10	0.033	57	0.016	0.008	0.028	0.028	C	0.015	C	65	135	53
11	0.035	39	0.011	0.008	0.031	0.031	A	0.008	A	64	140	57
12	0.029	48	0.015	0.008	0.024	0.024	B	0.008	B	66	135	52
13	0.062	66	0.028	0.008	0.049	0.049	L	0.022	L	62	130	130
14	0.000	0	0.007	0.008	0.023	0.023	E	-0.008	E	61	143	0
15	0.000	0	0.009	0.008	0.024	0.024		-0.008		61	143	0
16	0.000	0	0.009	0.008	0.025	0.025		-0.008		61	143	0
17	0.000	0	0.014	0.008	0.011	0.011		-0.008		61	143	0
18	0.000	0	0.015	0.008	0.010	0.010		-0.008		61	143	0
19	0.000	0	0.018	0.008	0.012	0.012		-0.008		61	143	0
20	0.000	0	0.021	0.008	0.001	0.001		-0.008		61	143	0
21	0.000	0	0.018	0.008	0.000	0.000		-0.008		61	143	0
22	0.006	34	0.023	0.008	0.000	0.000		-0.001		61	143	9
23	0.028	89	0.037	0.008	0.000	0.000		0.023		69	135	53
24	0.062	100	0.062	0.008	0.000	0.000		0.050		69	128	123
25	0.058	100	0.054	0.008	0.000	0.000		0.051		69	114	137
26	0.054	100	0.047	0.008	0.000	0.000		0.049		68	115	131
27	0.007	100	0.021	0.008	0.000	0.000		0.002		70	112	21
28	0.042	100	0.035	0.008	0.000	0.000		0.033		69	118	97
29	0.017	100	0.024	0.008	0.000	0.000		0.012		69	115	42
30	0.036	100	0.033	0.008	0.000	0.000		0.030		69	119	89
SUM	0.989	-	0.804	0.228	0.583	0.583	N.A.	0.479	N.A.	-	-	1893
AVG	0.033	70	0.027	0.008	0.019	0.019	N.A.	0.016	N.A.	64	133	63
NBS	Q302	N300	Q300	Q303	Q301	Q305	Q306	Q311	Q313	N305	N307	N308

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SPACE HEATING SUBSYSTEM

SITE: HOMES BY MARILYN
REPORT PERIOD: APRIL, 1979

SOLAR/1008-79/04

DAY OF MON.	SPACE HEATING LOAD MILLION BTU	SOLAR FR.OF LOAD PCT	SOLAR ENERGY USED MILLION BTU	OPER ENERGY MILLION BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FOSSIL FUEL MILLION BTU	ELECT ENERGY SAVINGS MILLION BTU	FOSSIL ENERGY SAVINGS MILLION BTU	BLDG TEMP DEG. F	AMB TEMP DEG. F
1	0.198	57	0.113	0.028	0.022	0.032	N	0.051	N	76	32
2	0.133	29	0.039	0.020	0.025	0.035	O	0.016	O	76	32
3	0.189	42	0.079	0.028	0.029	0.042	T	0.035	T	76	35
4	0.253	49	0.125	0.035	0.034	0.048		0.056		77	45
5	0.062	89	0.056	0.007	0.002	0.002	A	0.026	A	78	47
6	0.032	100	0.032	0.003	0.000	0.000	P	0.015	P	79	45
7	0.000	0	0.000	0.000	0.000	0.000	P	0.000	P	79	46
8	0.003	100	0.003	0.000	0.000	0.000	L	0.001	L	76	46
9	0.000	0	0.000	0.000	0.000	0.000	I	0.000	I	76	40
10	0.141	100	0.141	0.013	0.000	0.000	C	0.066	C	74	33
11	0.079	60	0.047	0.010	0.008	0.012	A	0.022	A	72	30
12	0.256	23	0.059	0.034	0.053	0.075	B	0.026	B	71	39
13	0.186	36	0.066	0.025	0.031	0.045	L	0.030	L	72	50
14	0.067	100	0.067	0.007	0.000	0.000	E	0.031	E	74	58
15	0.048	100	0.048	0.004	0.000	0.000		0.023		76	64
16	0.000	0	0.000	0.000	0.000	0.000		0.000		77	67
17	0.000	0	0.000	0.000	0.000	0.000		0.000		79	70
18	0.000	0	0.000	0.000	0.000	0.000		0.000		80	66
19	0.000	0	0.000	0.000	0.000	0.000		0.000		80	62
20	0.000	0	0.000	0.000	0.000	0.000		0.000		79	57
21	0.000	0	0.000	0.000	0.000	0.000		0.000		79	61
22	0.000	0	0.000	0.000	0.000	0.000		0.000		79	63
23	0.000	0	0.000	0.000	0.000	0.000		0.000		76	62
24	0.000	0	0.000	0.000	0.000	0.000		0.000		77	63
25	0.000	0	0.000	0.000	0.000	0.000		0.000		76	66
26	0.000	0	0.000	0.000	0.000	0.000		0.000		77	63
27	0.000	0	0.000	0.000	0.000	0.000		0.000		78	65
28	0.000	0	0.000	0.000	0.000	0.000		0.000		78	64
29	0.000	0	0.000	0.000	0.000	0.000		0.000		77	64
30	0.000	0	0.000	0.000	0.000	0.000		0.000		77	62
SUM	1.649	-	0.875	0.215	0.204	0.291	N.A.	0.397	N.A.	-	-
AVG	0.055	53	0.029	0.007	0.007	0.010	N.A.	0.013	N.A.	77	53
NBS	Q402	N400	Q400	Q403	Q401		Q410	Q415	Q417	N406	N113

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
ENVIRONMENTAL SUMMARY

SITE: HOMES BY MARILYN
REPORT PERIOD: APRIL, 1979

SOLAR/1008-79/04

DAY OF MONTH	TOTAL INSOLATION BTU/SQ.FT	DIFFUSE INSOLATION BTU/SQ.FT	AMBIENT TEMPERATURE DEG F	DAYTIME AMBIENT TEMP DEG F	RELATIVE HUMIDITY PERCENT	WIND DIRECTION DEGREES	WIND SPEED M.P.H.
1	2081	N	32	45	N	N	N
2	1568	O	32	44	O	C	O
3	2004	T	35	42	T	T	T
4	2301		45	59			
5	2224	A	47	65	A	A	A
6	2141	P	45	59	P	P	P
7	2178	P	46	60	P	P	P
8	2020	L	46	60	L	L	L
9	1053	I	40	48	I	I	I
10	963	C	33	38	C	C	C
11	1260	A	30	35	A	A	A
12	1653	B	39	50	B	B	B
13	2182	L	50	65	L	L	L
14	2150	E	58	79	E	E	E
15	2134		64	84			
16	1358		67	83			
17	1970		70	83			
18	2100		66	80			
19	2113		62	74			
20	2126		57	74			
21	2008		61	78			
22	1907		63	77			
23	1286		62	77			
24	1469		63	77			
25	1740		66	77			
26	1235		63	75			
27	1611		65	79			
28	1368		64	*			
29	1380		64	74			
30	1723		62	76			
SUM	53307	N.A.	-	-	-	-	-
AVG	1777	N.A.	53	66	N.A.	N.A.	N.A.
NBS ID	Q001		N113			N115	N114

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